

This Old House

Comparative Hazards of Paint Removal Techniques

Maintenance of old homes can be an extremely hazardous activity if improperly done. For example, lead poisoning can arise from exposure to lead-based paint chips as well as dust produced during prep work for repainting. In this issue, researchers led by Howard W. Mielke of Xavier University of Louisiana attempt to broaden the discussion by looking at a variety of metals existing in old paint besides lead, including cadmium, manganese, nickel, copper, cobalt, chromium, and vanadium [EHP 109:973–978]. They also compare the effect of two different paint renovation methods on the accumulation of lead in interior and exterior environments. Their findings illustrate the need for curtailing power sanding and the related hazards of metal dust in preparation for house painting, and suggest a safer method of preparation.

By pulverizing old paint, power sanding can release many paintbound metals that accumulate in the environment because they don't decompose. The authors note that in addition to lead, power sanding can release enough cadmium, manganese, and nickel to not only place painters at risk of overexposure but also "contribute to exposure during a critical window of childhood that may contribute to chronic health problems later on in life."

The study was inspired by the experiences of a New Orleans family that had undertaken the renovation of their wood frame 1920s house (house 1). Old paint was removed by a professional painting company by power sanding. Consequent health hazards first showed up when the family dog died six weeks after power sanding began. The family was forced to vacate their house, and all three children were hospitalized with elevated blood lead concentrations. When advised by the hospital not to return to their house, the family consulted Mielke for advice on dealing with their lead-contaminated home.

The painting project at house 2 was begun later. After observing the misfortune of their house 1 neighbors, the house 2 family chose to have their house dry-scraped in preparation for painting. Mielke and colleagues decided to conduct a case study on house 2 to determine whether scraping is a safer alternative for managing lead-based paint. The researchers collected dust and paint samples from the two houses. They also collected paint samples from 29 other houses in the city to determine the content of lead and other metals.

Elevated lead levels remained in house 1 even after repeated vacuuming with a HEPA-filter vacuum, mopping with a three-bucket procedure, and dusting with a tack cloth. Only after an intensive \$70,000 remediation, including painting all interior surfaces, sealing all porous wood surfaces, and cleaning outdoor surfaces with lead-specific detergents, did levels improve.

House 2, on the other hand, demonstrated that scraping paint is a relatively safe method for preparation and that it doesn't contribute to lead dust accumulation in either the interior or exterior of a house. The amount of lead dust after scraping but before cleaning did not differ significantly from before the project started. To be effective, though, scraping must be accompanied by diligent cleaning practices; in fact, after a thorough post-scraping



Hard lessons in the Big Easy. Research in the wake of lead poisoning in New Orleans shows that scraping is much safer than power sanding for removing old paint.

cleaning, the house was found to contain even less lead than before the project began.

The hazards from old paints aren't unique to New Orleans. All cities need to revise their codes to prevent poisoning from power sanding, says Mielke. The researchers make a number of recommendations to help protect the health of workers and families from this problem. Paint should be tested for lead before any painting project is begun, and power sanding should be prohibited by city ordinance. The public, moreover, should be educated about the hazards of dusts created by power sanding. The authors did not study encapsulants (special liquid coverings to contain lead), but suggest that they may be helpful in curtailing metal dust contamination from house paint. —Ron Chepesiuk

Firesafe but Not Failsafe

Flame Retardants Cause Neurotoxic Effects

Polybrominated diphenyl ethers (PBDEs), widely used as flame retardants, are emerging contaminants of concern. A 1998 study of Swedish women showed that PBDE concentrations in mothers' milk increased exponentially from 1972 to 1997, doubling every five years. PBDEs have been compared to polychlorinated biphenyls (PCBs) because of their similar ubiquitous distribution throughout the global environment, their structure, and their properties, including persistence and the ability to bioaccumulate. In light of these findings, Per Eriksson of the Department of Environmental Toxicology at Uppsala University and colleagues investigated the developmental neurotoxic effects of two PBDEs and another type of brominated flame retardant, tetrabromo-bisphenol-A (TBBPA), on young mice [EHP 109:903–908]. They report that PBDE 47 and PBDE 99 can cause behavioral disturbances similar to those caused by PCBs in laboratory experiments with mice—aberrations in motor behavior worsening with age and reduced learning and memory—while TBBPA produced no adverse effects.

The scientists investigated the spontaneous behavior and learning ability of groups of mice that were given one of two dosages of

PBDE 47, PBDE 99, or TBBPA at 10 days after birth. At 2 and 4 months postdosing, the spontaneous behavior of randomly selected groups of eight males was monitored for three consecutive 20-minute periods. The researchers observed habituation behaviors—moving around a new space, rearing up, and general exploration, all of which tend to decrease as a mouse gets used to a new environment. At both 2 and 4 months, during the first 20-minute period the PBDE-treated animals were less active than the controls, and this decrease correlated with increasing dose. During the second period the activities in all groups were comparable. During the third period the PBDE-treated animals appeared to be more active than the controls, with the increase again apparently dose-related. The authors report that this nonhabituating behavior worsens with age, as they are more pronounced in 4-month-old mice than in 2-month-old mice.

At 5 months postdosing, groups of 16–18 randomly selected males were tested using a Morris water maze. This is a common behavioral test in which mice use visual cues to find and remember the location of a platform submerged in a pool of water. This task provides a measure of many cognitive abilities, including analytical skills, learning and memory, and the ability to form strategies.

The decrease in the time taken to locate the platform over a total of 20 trials was used to demonstrate the animals' spatial learning ability. On day 5 the platform was relocated and the animals' performance of the maze test was measured over another 5 trials. The decrease in the time taken to find the relocated platform over the 5 trials was used as a measure of the animals' relearning ability. During the first part of the swim maze study, both treated and control animals performed to an equivalent standard. In the relearning stage of the study, mice exposed to the higher dose of PBDE 99 performed significantly worse than control animals, but those dosed with PBDE 47 were not significantly different from controls.

Based on the results of the 2-, 4-, and 5-month tests, the authors conclude that although both PBDEs cause adverse neurodevelopmental effects, PBDE 99 is the more potent neurotoxicant.

—Rebecca Renner

Large Volumes, Less Risk? HPV Chemicals May Be Safer than Thought

In 1997 the group now known as Environmental Defense (ED) published *Toxic Ignorance*, a report focused on the dearth of basic toxicologic information on high production volume (HPV) chemicals. These chemicals, which are used in various industries and as ingredients in consumer products, are manufactured or imported into the United States in amounts exceeding 1 million pounds annually (this does not include pesticides, drugs, or food additives). The report makes the point that environmental exposures to HPV chemicals seem likely, given the large volumes of the chemicals in commerce and industry, and that whether such exposures present a risk to people and the environment is unknown. However, an analysis conducted by Albert R. Cunningham and Herbert S. Rosenkranz, both of the Department of Environmental and Occupational Health at the University of Pittsburgh, suggests that the risk may be less than commonly anticipated [*EHP* 109:953–956].

Cunningham and Rosenkranz's analysis follows criteria for toxicity established in the Screening Information Data Set (SIDS) program of the Organisation for Economic Co-operation and Development. This international organization, composed of more

than 30 member nations and their chemical industries, created the SIDS program with the goal of screening HPV chemicals for toxicologic end points. The SIDS criteria are also being used for the HPV Chemical Challenge Program of the U.S. Environmental Protection Agency, which asks chemical producers and importers to provide basic toxicologic data on approximately 2,800 HPV chemicals. The criteria include tests for genotoxicity, acute and chronic toxicity, and reproductive toxicity.

With the goal of collecting such data humanely, economically, and efficiently, the Johns Hopkins Center for Alternatives to Animal Testing, ED, Carnegie-Mellon University, and the University of Pittsburgh collaborated in developing the TestSmart Program. The TestSmart Program explores the usefulness of structure–activity relationship modeling, an approach that can be used to predict a chemical's toxicity based on its molecular resemblance to another chemical with an established toxicity. Cunningham and Rosenkranz used the TestSmart method to conduct their research on HPV chemicals.

To investigate whether HPV chemicals as a group are notably toxic or not, Cunningham and Rosenkranz randomly selected 200 such chemicals for which toxicologic data are lacking. They also created a randomly chosen reference set of 10,000 chemicals to represent the universe of chemicals as a whole and serve as a control. Structure–activity relationship modeling was used to screen the chemicals and to predict the proportion within each set that could potentially yield specific end points. The modeling comprised tests for mutagenicity, genotoxicity, acute and chronic toxicity, and environmental fate.

The researchers were surprised to find that the proportion of HPV chemicals predicted to be toxic was significantly less than that in the reference set. Only one toxic end point, sister chromatid exchanges *in vitro*, which may indicate mutagenicity, was significantly higher in the HPV chemical set as compared to the reference set.

Cunningham and Rosenkranz speculate that the same qualities that make HPV chemicals useful in industry may provide an explanation for their finding. Properties such as stability and low reactivity allow chemicals to retain their function through storage and transport. In general, the researchers theorize, such properties may also relate to lower toxicity. —Julia R. Barrett



Bonus points? HPV chemicals appear to be some of the less toxic chemicals available, perhaps for the same reasons that make them so useful in commerce and industry.